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Effects of Drying, Lactic Acid, and an Antimicrobial Marinade on the Survival of Generic *Escherichia coli* on Biltong

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Objectives

The objective of the experiment was to evaluate the effects of drying, lactic acid spray, and a certain marinade application on the survival of generic *Escherichia coli* on biltong.

Materials and Methods

Frozen eyes of round (IMPS #171C) were obtained from a local beef purveyor. The eyes of round were thawed (at 4°C), trimmed of extra fat and connective tissues, and cut into strips ($L \times W \times T$; 6 in × 2 in × 0.75 in). The experiment was divided into 2 groups and replicated once. Experiment 1 was further sub-grouped into 3 treatments: (1) negative control (NC), (2) negative control for dip treatment (NCD), and (3) inoculated group (I). Experiment 2 was sub-grouped into 6 treatments: (1) negative control (NC), (2) negative control for dip treatment (NCD), (3) positive inoculated control (PIC), and inoculated treatments (4) marinated (M), (5) 2% lactic acid spray (LA), and (6) marinated and lactic acid spray (MLA). For both experiments 1 and 2, 12 strips of biltong were randomly selected for each treatment (n = 36 for experiment 1; n = 72 for experiment 2). The inoculated samples were dipped for 30 s in a cocktail (5-log) of 4 different strains of nalidixic adapted *Escherichia coli* (beef isolates) and allowed 2 h for attachment at 4°C. The lactic acid was sprayed to each side of the respective biltong and allowed a 10-min resting period. Marinade was applied to respective treatment groups by dipping, rubbing, and incubating overnight (at 4°C). All samples were kept in a smokehouse in a controlled environment with drying cycle at 78°F and 60% relative humidity. Experiment 1 was incubated in the smokehouse for a total of 12 d and experiment 2 was incubated for 9 d total. Samples from each treatment group were removed on Days 0, 2, 5, 7, 9, and 12 (experiment 1 only) for microbiological sampling and analysis. Samples were homogenized, serially diluted, enumerated on TSA plus 200 ppm nalidixic acid, and incubated at 35°C for 18–24 h. Colonies were counted after 24 h and colony counts were transformed into $\log_{10}$ CFU for reporting.

Results

The data for experiment 2 showed that the treatments LA, M, MLA, and PIC were able to achieve a 2.5–3 $\log_{10}$ CFU reduction after 9 d of drying. The M and MLA treatments exhibited a 2–3 $\log_{10}$ CFU reduction after 2 d of drying as compared with LA and PIC that showed a similar reduction in microbial counts after 9 d of incubation. The NC and NCD treatment groups resulted in no microbial growth from Day 0 till Day 9 of incubation. The data for experiment 1 showed that there was a 1 $\log_{10}$ CFU reduction of *E. coli* in treatment group I. The NC and NCD groups did not show microbial growth from Day 0 till Day 9 of incubation. The water activity decreased overtime to 0.722 for experiment 1 and 0.711 for experiment 2. Overall, the M and the MLA samples appeared to have the greatest and quickest killing effect on generic *E. coli*.

Conclusion

Results from these experiments suggest that the combination of drying with a lactic acid spray and marinade application causes a decrease in the *E. coli* population on Biltong during incubation for 9 or 12 d. While the results show that there may be a small decrease from drying alone, the greatest decreasing effect appears to be the combination of the drying, lactic acid, and marinade. Future work will include additional replicates and experiments with pathogens such as *E. coli O157:H7*.